in the Yorktown aquifer (Wilder et al. 1978); calcium in the groundwater apparently exchanges for sodium in the aquifer materials, thereby increasing the concentration of sodium and decreasing the concentration of calcium in the groundwater.

Withdrawals from the Yorktown are generally minor and the aquifer is readily recharged. Consequently, widespread water-level declines have not occurred in this aquifer. Near Belhaven, withdrawals of about 1.2 million gpd over a period of about 10 years have resulted in a water-level decline of less than 10 feet.

The major source of freshwater in the southeastern coastal area, where nearly all aquifers contain some saltwater, is the **Castle Hayne** (Figure I-4). In some locations where aquifers above and below the Castle Hayne contain saltwater, the Castle Hayne can yield freshwater. The Castle Hayne is the most productive of the state's principal aquifers. Wells that yield more than 1,000 gpm can be readily developed in the aquifer, and yields in excess of 2,000 gpm have been possible.

Water from the Castle Hayne is generally hard (121 to 180 mg/l as calcium carbonate) to very hard (greater than 180 mg/l) and may require treatment for some uses. Hardness is lower near recharge zones, but increases with residence time in the aquifer. In contrast, iron concentrations are more likely to exceed the state drinking water standard of 0.3 mg/l in recharge areas, but iron precipitates out as water moves through the limestone formation. Silica concentrations in excess of 50 mg/l are common, and saltwater may be found in the deeper parts of the aquifer.

The largest groundwater withdrawals in the state are from the Castle Hayne aquifer to decrease artesian pressure and de-water overlying phosphate ore beds at a phosphate mine in Beaufort County. Over 60 million gpd are withdrawn from the aquifer near Aurora, and, as a consequence, water levels have declined 5 feet or more in the Castle Hayne over an area of 1,300 square miles. Near the mine, a water level decline of over 80 feet has been observed since 1965 (Coble et al. 1985).

The **Cretaceous** aquifer (Figure I-4) is the most widely used aquifer in the Coastal Plain, with much of the withdrawals coming from the central and southern parts of the province. The aquifer occurs at depths of between 100 and 600 feet below land surface (800 feet in some sites) and is very thick relative to the other principal aquifers in the state. Individual wells in the Cretaceous aquifer typically produce between 200 and 400 gpm; some well fields in the aquifer produce more than one million gpd.

Water from the Cretaceous aquifer is generally soft and alkaline and requires little or no treatment for must uses. Water from some parts of the aquifer may, however, contain fluoride concentrations in excess of 4 mg/l, which is the maximum allowable concentration under national drinking water standards (U.S. Environmental Protection Agency 1986). Hence, the presence of excessive fluoride may limit the use of water for drinking from some parts of the aquifer. Additionally, the Cretaceous aquifer generally contains brackish water in the deeper parts of the aquifer (Figure I-4).

Because the Cretaceous aquifer is heavily utilized throughout the Coastal Plain, declines in water level are widespread throughout the area. An observation well in the Cretaceous aquifer near Kinston has shown water level declines of 80 feet or more since 1968. Water levels have declined over an area of several thousand square miles in northeastern North Carolina because of withdrawals of 35 million gpd or more near Franklin, Virginia (about 10 miles north of the state line).